ON THE FAUNA OF THE SANDY SOIL GRASSLAND AT BUGAC

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Abstract

59 217 insects were collected by emergence traps in an ungrazed semi-natural grassland from 1976 to 1979 in the Kiskunság National Park ("KNP", Hungary). Qualitative and quantitative relations of the material collected are discussed on order level. Summing up the four year results p. c. distribution of the fauna is as follows: Hymenoptera 23.9%; Homoptera 16.6%; Diptera 10.5%; Acari 7.7% and Coleoptera 5.3%. In average 6795 individuals per sq. m. were collected during whole season with a maximum of 11 875 ind. per m^2. The distribution, weather hazards, dependent fluctuation as well as the importance of constant and changing traps were also examined. In unfavourable dry periods the majority of animals could leave the area. Owing to good environmental conditions individuals having immigrated from surrounding pastures also survived. 39% of the individuals examined developed in deeper wind furrows. Diplopoda, Thysanoptera, Lepidoptera and Araneida groups prefer wind furrows while Orthoptera, Homoptera, Hymenoptera and Acari were mostly collected on sand dunes. This preference depends on the season, as well. The following seasonal maxima of the important orders were established: Orthoptera: early summer; Cicadinea: early and late summer; Lepidoptera: May-June and August–September; Heteroptera: July.

Introduction

One of the most characteristical natural conservancy areas of Kiskunság National Park (KNP) is the semi-natural grassland in the neighbourhood of Kecskemét, Jakabszállás and Bugac. This grazed grassland covers about 2000 ha and a smaller plot was isolated for ecological investigations at the eastern edge of it.

The area consists of sand dunes and wind furrows that are sometimes 2 m deep (Fig. 1 and 2) having different microclimatical conditions and plant communities (KÖRMÖCZI, BODROGKÖZY and HORVÁTH, 1981). Sand dunes are covered by Festucetum vaginatae danubiale normale, *Potentillo-Festucetum pseudovinae danubiale euphorbietosum seguerianae* and its *Bromus tectorum* facies. In wind furrows (Fig. 2) *Lolio-Potentilletum anserinae* can be found with *Festuca pseudovina* facies (BODROGKÖZY and FARKAS, 1981).

We suppose that the most important factor for the knowledge of basic fauna is to investigate the animals having developed and active in the same area although there are a lot of faunistic elements that immigrate from a natural landscape with sand dunes belonging to KNP as well, from a forest at the edge of sampling area or perhaps from agricultural lands. This paper is a qualitative and quantitative elaboration of the material collected for four years and containing animals having developed in the investigation area. Further elaborations and evaluations are due in the future.

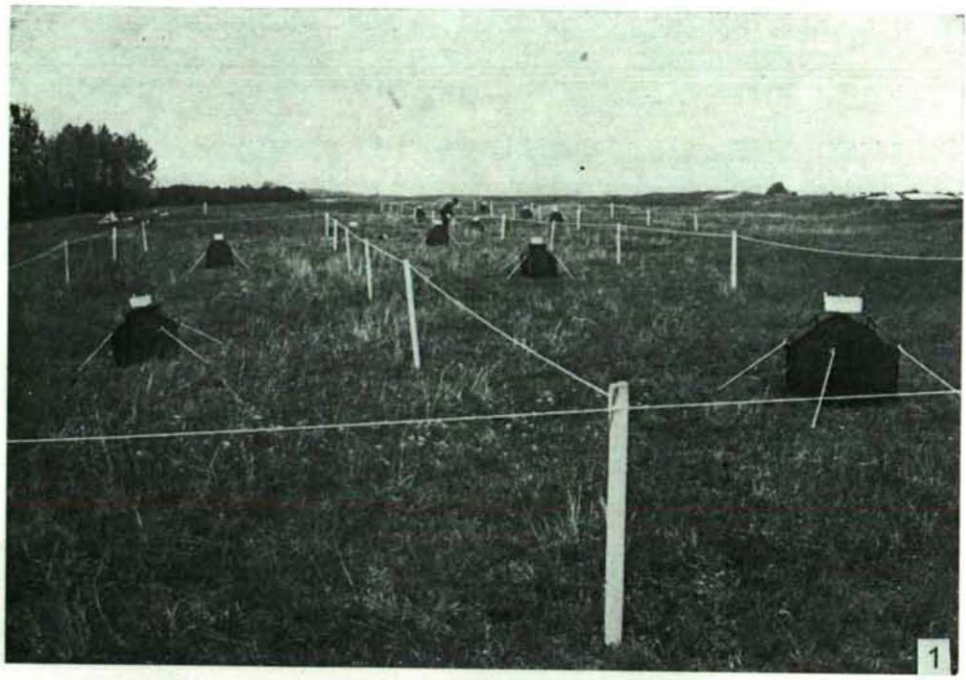

Fig. 1. Ten emergence traps in the natural conservancy area of Kiskunság National Park.

Fig. 2. Emergence traps on the light-coloured sand dunes and in the darker wind furrows.

There are several works on the fauna of typical Bugac area (FRIDVALSZKY, 1892; BIRÓ, 1896; MÓCZÁR, 1938; 1942; 1943; GOZMÁNY, 1954; SZELÉNYI, 1957; NAGY, 1958; KIS-ÚJHELYI, 1965; TÓTH, 1967; SZELÉNYI–NAGY–SÁRINGER, 1974; PAPP, 1975; VOJNITS, 1976). No other work has been made in Hungary with the methods used in this work with an exception of MÓCZÁR and BIRÓ (1980).

Methods

Emergence trap was introduced by SOUTHWOOD (1971) and observed in 1955 in Central High Alps: Obergurg area. It is the most useful to collect insects developing in the soil and in the plant layer. Janetschek and coworkers (1977) used these traps to observe the fauna of meadows at different heights. The basic area of this trap is 50 by 50 cm. The collection space is isolated by black tulle on an iron frame. Traps were dig some centimeters into the soil. In the fourth year bronze nets were also used and no modifications were observed in the collected material. Collecting vessels were in 60 cm height (Fig. 1, 2) and in the centre of the soil covered by emergence trap a Barber trap was placed. 50% ethylene glycol was used in both types of traps and were emptied in every month. Ten traps were used in every year from 28th April to 21st October in 1976, from 31st March to 3rd November in 1977, from 15th March to 16th November in 1978 and from 15th March to 5th November in 1979, so altogether 580 samples were collected. Five traps were used permanently in the same place and five were transplanted in every month within an area of 25 m². Traps were put in the deeper parts of the area with dense vegetation cover, too (Fig. 2). We used these two types of traps because the number of animals developing tn unit area could be estimated on the basis of the material of permanent traps and changing iraps collected the animals occuring in the trapped area. Differences between these two types

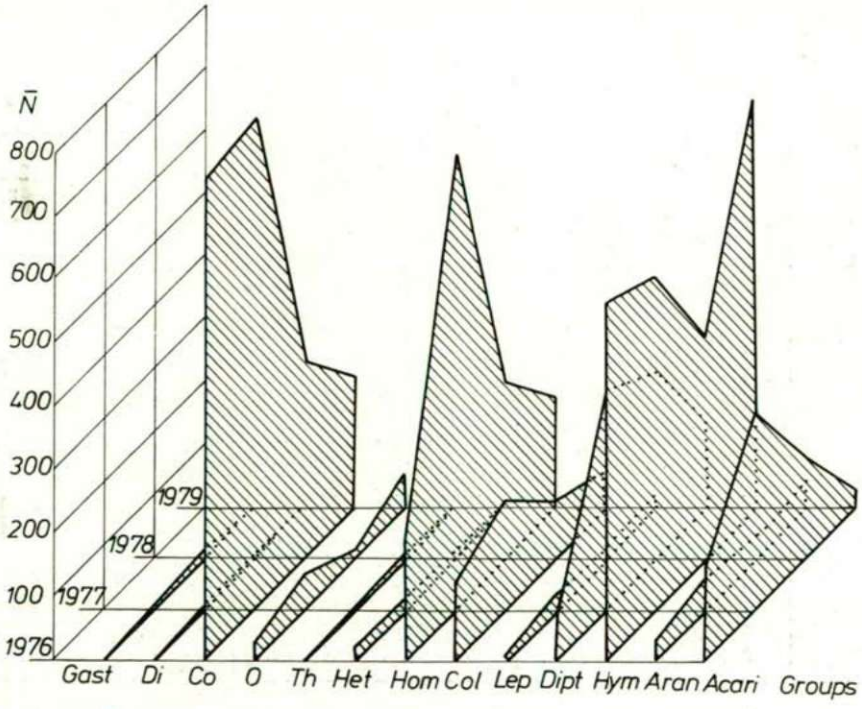

Fig. 3. Annual fluctuations in average number of important taxonomic groups.

were caused by the different life span of animals (depending on the role of predators, traps etc.) and the influence of surrounding areas (migration). Otherwise the effeciency of captures cannot be 100% because populations of certain species can avoide to get into the collecting solution (e.g. species with reduced locomotion activity).

P. KESZEI and F. ACSAI helped in handling traps, collected materials were preserved and handled by ANNA FAZEKAS, and Dr. GABRIELLA SZŐNYI-DOMOKI helped in evaluating the collection data. Authors are grateful for their valuable help.

Taxonomical distribution of material collected

The total number of specimens collected in the 290 sample during four years was 59 257 (Table I). Groups that have less than 100 specimens were not evalueted in the Table I. The percentage data of the taxonomic groups in the Table correspond to the total number of specimens collected during the whole four year period in the constant and changing traps. The p.c. group distribution of the total collected material can be seen in the last column. The most numerous groups are: Hymenoptera: 14 981 specimens, 25.3% (mainly ants); Collembola: 14 142 specimens, 23.88% and Homoptera: 9814 specimens, 16.58% (mainly Aphids). The maximum number of ants is due to immigration into the trapped areas. The high number of Collembola

Table 1. Annual distribution of mean number in collected material.

	1976				1977				1978			
	c		v		c		v		c		v	
	N	%	N	%	N	%	N	%	N	%	N	%
Di	1	0.98	—	—	15	14.71	13	12.75	26	25.49	35	34.31
Co	2898	20.49	1631	11.53	2706	19.13	2789	19.72	1251	8.85	1208	8.54
O	64	5.94	105	9.75	219	20.33	168	15.6	32	2.97	58	5.39
Th	3	2.0	11	7.33	37	24.67	15	10.0	28	18.67	38	25.33
Het	43	10.14	71	16.75	81	19.1	51	12.03	79	18.63	38	8.96
Hom	854	8.7	269	2.74	4359	44.4	681	6.94	1746	17.78	487	4.96
Col	206	6.59	529	16.92	670	21.43	537	17.17	340	10.87	364	11.64
Lep	29	5.46	40	7.53	91	17.14	86	16.19	56	10.55	62	11.68
Dipt	168	2.69	198	3.17	1254	20.09	1182	18.94	1175	18.82	1169	18.73
Hym	2225	14.85	1152	7.69	2003	13.37	1675	11.18	1150	7.68	1635	10.91
exc. Form	153	5.49	213	7.64	499	17.91	490	17.59	378	13.57	468	16.80
Aran	79	6.78	111	9.53	174	14.93	193	16.57	130	11.16	137	11.76
Acari	460	10.04	418	9.13	1403	30.63	757	16.52	712	15.54	578	12.62
Gast	2	2.04	—	—	1	1.02	4	4.08	19	19.4	61	62.24
Isop	—	—	3	5.88	21	41.18	1	1.96	21	41.18	1	1.96
Chil	—	—	—	—	—	—	1	16.67	4	66.66	—	—
Blat	8	11.59	4	5.8	5	7.25	13	18.84	23	33.33	11	15.94
Mant	—	—	1	33.33	—	—	—	—	—	—	1	33.33
Plec	—	—	2	100.0	—	—	—	—	—	—	—	—
Derm	1	100.0	—	—	—	—	—	—	—	—	—	—
Psoc	—	—	—	—	1	50.0	1	50.0	—	—	—	—
Neur	—	—	3	42.85	—	—	—	—	1	14.29	2	28.57
Trich	—	—	1	100.0	—	—	—	—	—	—	—	—
Inv	225	8.68	151	5.83	1581	61.0	335	12.92	12	0.46	17	0.66
Others	9	20.0	6	13.34	14	31.11	14	31.11	—	—	2	4.44
Total	7275	60.72	4706	39.27	14 635	63.21	8516	36.78	6805	51.21	5904	48.87

	1979				1976–79				1976–79	
	c		v		c		v		c+v	
	N	%	N	%	Σ N	%	Σ N	%	Σ N	↓%
Di	3	2.94	9	8.82	45	44.12	57	55.88	102	0.17
Co	296	2.1	1363	9.64	7151	50.57	6991	49.43	14142	23.88
O	249	23.12	182	16.9	564	52.37	513	47.63	1077	1.82
Th	8	5.33	10	6.67	76	50.67	74	49.33	150	0.25
Het	25	5.9	36	8.49	228	53.77	196	46.23	424	0.72
Hom	697	7.1	725	7.38	7656	77.98	2162	22.02	9818	16.58
Col	183	5.85	289	9.53	1399	44.74	1728	55.26	3127	5.28
Lep	55	10.36	112	21.09	231	43.5	300	56.5	531	0.90
Dipt	437	7.00	659	10.56	3034	48.61	3208	51.39	6242	10.54
Hym	2570	17.16	2571	17.16	7948	53.05	7033	46.95	14981	25.3
exc. Form	220	7.89	364	13.07	1250	44.88	1535	55.11	2785	4.7
Aran	148	12.7	193	16.57	531	45.58	634	54.42	1165	1.97
Acari	138	3 01	115	2.51	2713	59.22	1868	40.78	4581	7.73
Gast	1	1.02	10	10.2	23	23.47	75	76.53	98	0.17
Isop	—	—	4	7.84	42	82.35	9	17.65	51	0.09
Chil	—	—	1	16.67	4	66.66	2	33.34	6	0.01
Blat	—	—	5	7.25	36	52.17	33	47.83	69	0.11
Mant	1	33.33	—	—	1	33.33	2	66.67	3	0.005
Plec	—	—	—	—	—	—	2	100.0	2	0.003
Derm	—	—	—	—	1	100.0	—	—	1	0.001
Psoc	—	—	—	—	1	50.0	1	50.0	2	0.003
Neur	1	14.29	—	—	2	28.57	5	71.43	7	0.012
Trich	—	—	—	—	—	—	1	100.0	1	0.001
Inv	89	3.43	182	7.02	1907	73.57	685	26.43	2592	4.38
Others	—	—	—	—	23	51.11	22	48.89	45	0.075
Total	4901	43.08	6475	56.92	33 616	56.76	25 601	43.23	59 217	100

Table 2. Total annual number (N) and monthly average ($\bar{x}$) of important taxonomic groups.

Group	1976		1977		1978		1979	
	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$
Gastropoda	2	0.33	5	0.71	80	10.0	11	1.375
Diplopoda	1	0.17	28	4.0	61	7.625	12	1.5
Collembola	4529	754.83	5495	785.0	2459	307.375	1659	207.375
Orthoptera	169	28.17	387	55.28	90	11.25	431	53.875
Thysanoptera	14	2.33	52	7.42	66	8.25	18	2.25
Heteroptera	114	19.0	132	18.86	117	14.625	61	7.625
Homoptera	1123	187.17	5040	720.0	2233	279.125	1422	177.75
Coleoptera	735	122.5	1207	172.43	704	88.0	481	60.125
Lepidoptera	69	11.5	177	25.28	118	14.75	167	20.875
Diptera	366	61.0	2436	348.0	2344	293.0	1096	137.0
Hymenoptera	3377	562.83	3678	525.43	2785	348.125	5141	642.625
(exc Form.)	366	61.0	989	141.28	846	105.75	584	73.0
Araneidea	190	31.67	367	52.43	267	33.375	341	42.625
Acari	878	146.33	2160	308.57	1290	161.25	253	31.625

is reasonable, their number was more than ten times higher in sodic areas (MÓCZÁR and BIRÓ, 1980). 10.54 p.c. of the basic fauna is Diptera (6942 individuals) 7.73% (4581 specimens) are Acari and 5.28% (3127 specimens) are Coleoptera. The number of Acari is uncertain for technical reasons. With the exception of Araneidea (1165 specimens, 1.97%) and Orthoptera (1077, 1.82%) the other groups represent less than 1%.

Since the investigation periods were different for a more exact comparison the annual average of main groups is demonstrated, as well in Table II and Fig. 3.

Relations between climate and collected material

The following 8 groups had the highest average number of individuals in 1977: Collembola, Orthoptera, Homoptera, Coleoptera, Lepidoptera, Diptera, Araneidea and Acari. The mean temperature of the season was the highest in that year during the investigation period, 14.71 °C. The precipitation was 258 mm and it was very low comparing with the average (343 mm). There were semiarid conditions in July (Fig. 4) and there was a shortage of precipitation also in spring and autumn. This climate is advantageous for the development of above mentioned groups.

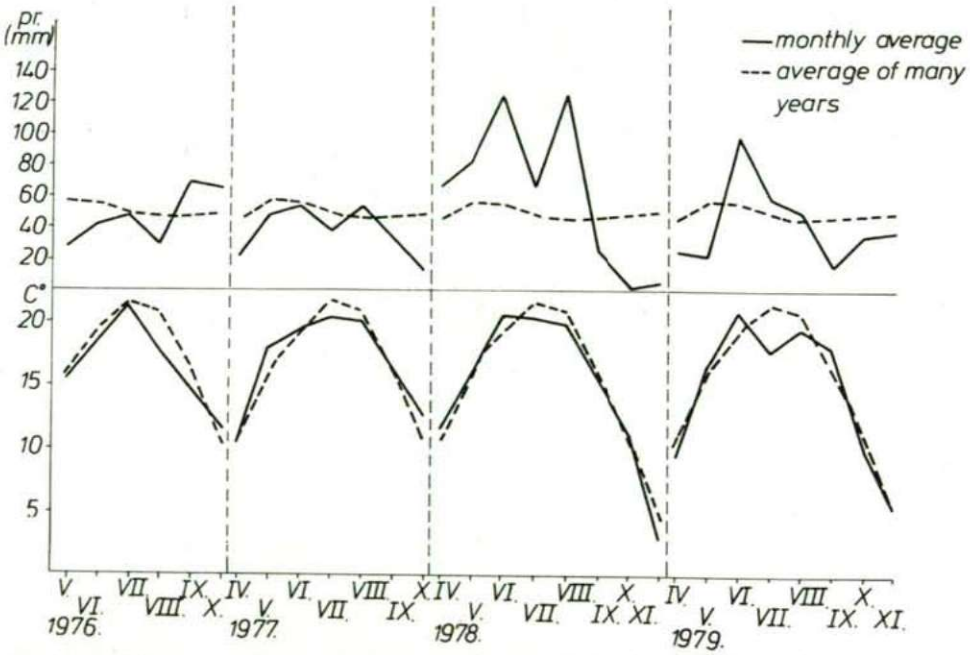

Fig. 4. Monthly average temperature and precipitation in the investigation period.

Five groups had the highest average in 1978: Gastropoda, Thysanoptera, Isopoda and Blattoidea (Table I). In that year the mean temperature was 14.08 °C, so fell between 1977 and 1979 average but the precipitation was unusually high in spring and summer, it reached 491 mm in the growing season that is 100 mm higher than the many year average. Since the highest precipitation was in July and August

it was especially advantageous for the vegetation. This is the reason of the high amount of hygrophilé animals.

Only Heteroptera had a maximum in 1976. Precipitation was 276 mm, 22 mm less than the average of many years and especially May and August were poor in precipitation. Average temperature was relatively low.

Hymenoptera was the only order having maximum in 1979. Average temperature of growing season was a little lower than in other years, 13.85 °C. Precipitation was 57 mm less than the average but it concentrated to the summer period. The water shortage in spring caused a two week delay in the development of the vegetation.

Not considering ants because of their special way of life, the number of collected individuals belonging to other Hymenoptera groups (mainly Terebrantes) was 2785 and it means maximum in the relation of the four years.

Upper and lower traps

On the basis of four year data Diplopoda, Collembola, Orthoptera and Acari were in greater proportion in Barber traps while the percentage ratio of Thysanoptera, Homoptera, Coleoptera, Lepidoptera and Diptera was higher in the upper traps. The quantity of Araneidea was almost the same in both types of traps (50.21 and 49.79% respectively) (Table 3.).

The details are not so unambigous. In the constant traps 51.22% was collected by the lower and only 48.78% by the upper traps. In the changing traps 48.58% was collected by the lower and 51.42% in the upper traps. The majority of Hymenoptera were in the lower traps because of the high proportion of ants. Majority of Heteroptera species was expected in the upper traps but their 57.08 percentage was represented in the lower traps and only 42.92% was collected in the upper traps so they were active mostly on the surface of soil and not on the vegetation.

There are some contradictory cases in the annual data, e.g. in 1977 only 36% of Diplopoda was collected in the lower and 64% in the upper traps. In 1976 and 1978 only 37–42% of the Homoptera was in the upper, 63–58% in the lower trap. It is obvious both in the global 4-year result and in the results of the upper and the lower traps respectively. The smaller amount appeared in the constantlower (41%), and in the changingupper traps (48%). The bigger amount of the Homoptera appeared in the constantupper (58%), and in the changing-lower traps (52%). It is obvious that the animals got into the traps set opposite to their living places when trying to escape. The contradictory phenomena mentioned above are the consequences of the fact that the number of species of the listed taxonomic categories are too big, the populations belong to different types of way of living. Only the accurate examination of these and the clarification to the species will lead to satisfactory results.

The constant and the changing traps

If we examine the last line of Table I where we summed the hived animals regardless to their proper taxonomic place, it will be clear that both in the global results of the 4 years (56.76%) and in the years 1976, 1977, 1978 (60.72%, 63.21%, 51.21%) the bigger amount was collected in the constant trap, while in 1979 the situation was just the opposite: only 43.08% of the animals got to the constant trap, the others (56.92%) got to the changing one.

Table 3. P. c. distribution between upper and lower traps.

Group		1976	1977	1978	1979	1976–79 Σ
Diplopoda	u	100	64.29	6.56	16.67	24.51
	l	—	35.71	93.44	83.33	75.49
Collembola	u	38.24	50.19	21.31	9.64	36.59
	l	61.76	49.81	78.69	90.36	63.41
Blattodea	u	83.33	83.33	82.35	60	81.16
	l	16.67	16.67	17.65	40	18.84
Orthoptera	u	42.6	30.75	22.22	19.03	27.2
	l	57.4	69.25	77.78	80.97	72.8
Thysanoptera	u	35.71	82.69	75.76	77.78	74.67
	l	64.29	17.31	24.24	22.22	25.33
Heteroptera	u	50	46.97	24.79	55.74	42.92
	l	50	53.03	75.21	44.26	57.08
Homoptera	u	36.51	72.88	42.36	37.41	56.64
	l	63.49	27.12	57.64	62.59	43.36
Coleoptera	u	48.03	63.79	74.29	54.68	61.05
	l	51.97	36.21	25.71	45.32	38.95
Lepidoptera	u	81.16	90.4	67.8	74.85	79.28
	l	18.84	9.6	32.2	25.15	20.72
Diptera	u	61.75	83.13	78.5	81.48	79.85
	l	38.25	16.87	21.5	18.52	20.15
Hymenoptera	u	23.22	36.27	33.79	40.75	34.4
	l	76.78	63.73	66.21	59.25	65.6
Araneidea	u	22.63	50.41	56.55	60.41	50.21
	l	77.37	49.59	43.45	39.59	49.79
Acari	u	27.33	33.19	23.41	27.67	29.01
	l	72.67	66.81	76.59	72.33	70.99

As regards the global number of specimens there were more entities of 7 taxonomic categories in the constant traps, than in the changing ones. These are: the Coleoptera, Orthoptera, Thysanoptera, Heteroptera, Homoptera, Hymenoptera, and Acari. In the changing traps the following 5 categories were represented in bigger number: Diplopoda, Coleoptera, Lepidoptera, Diptera, and Araneida. Besides the differences of the percentages of the same groups between the constant and the changing traps are not too significant, for example: Collembola, Thysanoptera, Diptera (C:V) 2%; Orthoptera 4%; Hymenoptera 7%; Heteroptera and Araneida 8%; Coleoptera 10%; Diplopoda 12%; Lepidoptera 13%; Acari 18%. It seems that according to the 4-year global data the separation has no significance. Only the Homoptera's presence is significant: there were 56% more in the constant traps than in the changing ones (77.98:22.2%). The possibly reason of this must be the quick increase in the number of the aphids. In the constant trap as a sealed space — during several months — their number can quickly grow in spite of the fact that those which had got to the destroying liquid were removed at the monthly emptyings,

but those which remained alive under the net could continue to multiplicate. However the animals always spread from the changing traps after a month.

If we look at the annual data, the differences are greater, there are even contradictory results. Where the 4-year global number was bigger in the constant trap, generally the changing trap caught more animals in two years. This fact may explain the relatively small differences of the 4-year results mentioned above by it. For example the Heteroptera:

1977=const. 61.36%: chang. 38.63% 1976=chang. 62.28%: const. 37.71%
1978=const. 67.52%: chang. 32.47% 1979=chang. 59.01%: const. 40.98%.

Relations of abundancy

The data reduced to specimen/m² are in Table IV. If we add up the number of entities caught by the constant traps, we get how many animals develop minimally from the group in question on a given area (1 m²). So the annual summary is important here. In the case of the changing trap, when it is put to a new place, the results can be decisively different because of the animals having already been there, and because of the eggs laid meanwhile. Besides, we must not ignore the free im- and outmigration before the translocation and the intense predation. If for example the migration is rather insignificant, the predation will be the main reason for the differences. If the immigration is intense or more generations are developing because of further egg laying, the number of individuals will be greater in the changing than in the constant trap. If the outmigration is more intense, the number of individuals will be greater in the constant trap than in the changing one. The data of the changing traps can be closer to real conditions, i.e. the reflect the amount of the populations that can be found and can survive on the area.

According to the constant separators a 4-year average of entities developing per m² are 6795 individuals. This amount varies year by year, the maximum, 11 875 was in the dry year of 1977 (Table IV). The May peak of the Collembola (918 p/m²) and the high number of entities of the Homoptera in June–July (930 and 1266 p/m²) contributes to this large number. The amount of the Hymenoptera (1602), the Acari (1122) and the Diptera is also significant. The 1976 datum (5842 p/m²) approaches the average, most while the number of animals per area has decreased since 1978 (5499 and 3963) specimens. This decrease is caused by the strong decrease of the Collembola (from 1001 to 237), the Homoptera (from 1397 to 558), the Diptera (from 940 to 349) and the Acari (from 570 to 110). The amount of the Hymenoptera (from 920 to 2056) and the Orthoptera (from 26 to 199) however increased. The majority of the animals grow till August.

From the connection between the constant and the changing traps we can draw a conclusion how the conditions of the areas in each year promoted the survival of the animals, when the mortality and migration were higher and how each group was influenced by them. The greatest difference between the traps was in 1977: under the changing traps we could find only half of the number found under the constant ones. In spite of the fact that the number of growing animals was the highest here, most of them possibly left the ares because of the draughty weather.

It is obvious in the case of the Homoptera. In 1978 however the difference was very small, the proportion even shifted in favour of the changing traps in special

Table 4. Monthly density data of important groups. 1976

Group	N/m²	V	VI	VII	VIII	IX	X	V–X	Monthly average
Di	c	—	—	0.8	—	—	—	0.8	0.13
	v	—	—	—	—	—	—	—	—
Co	c	415.6	619.2	445.6	212.0	38.4	736.0	2466.8	411.1
	v	415.6	472.8	52.8	130.4	60.8	24.0	1156.4	192.73
O	c	32.8	16.8	2.4	7.2	5.6	0.8	65.6	10.93
	v	32.8	16.0	16.8	3.2	0.8	—	69.6	11.6
Th	c	1.2	—	—	1.6	—	—	2.8	0.46
	v	1.2	0.8	0.8	4.0	—	1.6	8.4	1.40
Het	c	6.4	8.0	11.2	4.8	0.8	2.4	33.6	5.6
	v	6.4	13.6	11.2	9.6	8.0	8.8	57.6	9.6
Hom	c	41.2	96.8	60.8	377.6	32.0	80.0	688.0	114.6
	v	41.2	51.2	63.2	25.6	10.4	18.4	210.0	35.00
Col	c	146.4	44.8	20.0	15.2	6.4	12.8	245.6	40.93
	v	146.4	85.6	55.2	24.8	16.8	13.6	342.4	57.06
Lep	c	6.8	4.8	2.4	5.6	2.4	1.6	23.56	3.92
	v	6.8	8.0	2.4	12.0	1.6	0.8	20.2	3.36
Dipt	c	40.8	20.0	8.8	32.8	16.8	19.2	138.4	23.06
	v	40.8	44.0	31.2	19.2	2.4	16.8	154.4	25.73
Form	c	423.2	112.0	665.6	164.8	22.4	8.0	1396.0	232.7
	v	423.2	188.0	320.0	38.4	16.0	5.6	991.2	165.2
Hym	c	31.2	12.8	20.8	42.4	13.6	17.6	138.4	23.1
Others	v	31.2	30.4	40.0	39.2	16.0	19.2	176.0	29.3
Aran	c	18.0	13.6	10.4	9.6	7.2	3.2	61.98	10.33
	v	18.0	19.2	32.8	16.0	1.6	2.4	90.0	15.0
Acari	c	64.4	28.8	49.6	101.6	16.8	129.6	390.8	65.13
	v	64.4	27.2	18.4	139.2	1.6	60.8	311.6	51.93
Others	c	38.8	15.2	56.8	40.8	16.0	21.6	190.0	31.66
	v	38.8	28.0	43.2	22.4	4.0	6.4	142.8	23.80
Total	c	1266.8	992.8	1354.4	1016.0	178.4	1032.8	5842.4	
	v	1266.8	984.8	688.0	484.0	140.0	178.4	3730.6	

Table 4. 1977

Group	N/m²	IV	V	VI	VII	VIII	IX	X	IV–X	Monthly average
Di	c	0.4	—	1.6	—	0.8	0.8	0.8	11.93	1.70
	v	0.4	0.8	0.8	—	0.8	1.6	6.4	10.40	1.48
Co	c	802.8	917.6	396.0	221.6	84.0	69.6	8.0	2499.6	357.08
	v	802.8	741.6	148.0	80.8	80.8	42.4	—	1896.4	270.91
O	c	5.2	35.2	72.8	28.0	23.2	8.8	1.6	174.8	24.97
	v	5.2	72.0	16.0	23.2	4.0	10.4	4.0	134.8	19.25
Th	c	1.2	0.8	7.2	6.4	6.4	5.6	1.6	29.1	4.15
	v	1.2	2.4	1.6	1.6	2.4	3.2	—	12.4	1.77
Het	c	0.8	5.6	20.8	12.8	12.8	6.4	5.6	64.7	9.25
	v	0.8	4.8	9.6	4.8	12.8	4.8	3.2	40.7	5.82
Hom	c	77.2	81.6	930.4	1266.4	227.2	550.4	357.6	3490.8	498.68
	v	77.2	241.6	72.0	17.6	60.8	52.0	20.0	541.2	77,31
Col	c	51.6	98.4	200.0	64.0	43.2	32.2	47.2	536.4	76.62
	v	51.6	222.4	52.8	26.4	24.0	24.8	27.2	429.2	61.31
Lep	c	—	20.8	24.8	2.4	12.8	10.4	1.6	72.8	10.4
	v	—	26.4	14.4	—	2.4	25.6	—	68.7	9.82
Dipt	c	154.4	171.2	322.4	167.2	124.8	69.6	56.0	1065.6	152.2
	v	154.4	198.4	259.2	88.8	59.2	53.6	69.6	883.2	126.17
Form	c	109.2	88.8	316.8	232.8	152.0	108.0	123.2	1130.8	161.5
	v	109.2	274.4	388.0	120.8	45.6	64.0	18.4	1020.4	145.8
Hym	c	25.6	45.6	72.8	71.2	66.4	85.6	40.8	408.0	58.3
Others	v	25.6	72.0	105.6	45.6	40.8	74.4	19.2	383.2	54.7
Aran	c	14.8	24.0	57.6	12.0	10.4	12.0	8.8	139.6	19.94
	v	14.8	18.4	63.2	24.8	9.6	16.0	7.2	154.0	22.00
Acari	c	271.2	301.6	173.6	151.2	55.2	60.0	24.8	1037.6	148.22
	v	271.2	212.0	76.8	35.2	25.6	64.0	5.6	690.4	98.62
Others	c	113.2	150.4	342.4	504.0	26.4	64.8	12.0	1213.0	173.28
	v	113.2	97.6	95.2	55.2	8.0	6.4	6.4	382.0	54.57
Total	c	1627.6	1941.6	2939.2	2740.0	845.6	1084.0	696.8	11 874.8	
	v	1627.6	2184.8	1303.2	524.8	376.8	443.2	187.2	6647.6	

Table 4.

1978

Group	N/m²	IV	V	VI	VII	VIII	IX	X	XI	IV–XI	Monthly average
Di	c	3.2	0.8	1.6	0.8	3.2	1.6	4.0	4.0	19.2	2.40
	v	3.2	—	—	—	9.6	2.4	7.2	7.2	24.0	3.0
Co	c	58.8	70.4	62.4	145.6	381.6	136.8	122.4	12.0	990.0	123.75
	v	58.8	89.6	28.8	176.8	327.2	110.4	168.8	16.8	977.2	122.15
O	c	—	1.6	4.0	14.4	1.6	2.4	1.6	—	25.6	3.20
	v	—	4.8	25.6	5.6	9.6	0.8	—	—	46.4	5.80
Th	c	2.4	8.8	2.4	4.8	4.0	—	—	—	22.4	2.80
	v	2.4	5.6	7.2	12.0	0.8	—	2.4	—	30.4	3.80
Het	c	1.6	2.4	0.8	12.8	29.6	12.0	2.4	—	61.6	7.7
	v	1.6	3.2	5.6	4.0	10.4	2.4	2.4	2.4	32.0	4.0
Hom	c	24.0	23.2	480.8	228.8	169.6	253.6	175.2	50.4	1405.6	175.7
	v	24.0	41.6	76.80	90.4	56.0	23.2	60.8	8.0	380.8	47.6
Col	c	29.2	39.2	48.0	42.4	40.8	33.6	33.6	7.2	274.0	34.25
	v	29.2	28.8	43.3	32.0	80.0	25.6	31.2	19.2	289.2	36.15
Lep	c	0.4	4.8	8.8	5.6	20.0	4.8	—	—	44.4	5.55
	v	0.4	9.6	8.8	4.8	17.6	4.8	0.8	3.2	50.0	6.25
Dipt	c	24.8	67.2	108.0	200.0	146.4	80.0	258.4	68.0	952.8	119.1
	v	24.8	22.4	141.6	130.4	227.2	63.2	284.8	28.0	922.4	115.3
Form	c	60.0	28.0	48.0	144.0	224.8	108.8	31.2	2.4	647.2	80.9
	v	60.0	127.2	176.0	173.6	263.6	68.0	31.2	4.8	904.0	113.0
Hym	c	5.2	6.4	31.2	36.8	81.6	63.2	48.8	26.4	299.6	37.45
Others	v	5.2	8.0	39.2	71.2	68.0	64.8	117.6	3.2	377.2	47.15
Aran	c	7.8	8.0	7.2	16.8	25.6	15.2	15.2	9.6	105.4	13.17
	v	7.8	14.4	6.4	19.2	25.6	12.0	12.8	9.6	107.8	13.47
Acari	c	78.8	23.2	91.2	126.4	123.2	49.6	84.0	12.0	587.6	73.45
	v	78.8	55.2	55.2	80.8	44.0	15.2	108.8	7.2	444.4	55.55
Others	c	0.4	0.8	9.6	4.8	24.0	15.2	7.2	1.6	63.6	7.95
	v	0.4	3.2	36.8	14.4	15.2	4.0	2.4	—	76.4	9.55
Total	c	295.8	284.8	904.0	984.0	1276.0	776.8	784.0	193.6	5499.0	
	v										

Table 4.

Group	N/m²	1979 IV	V	VI	VII	VIII	IX	X	XI	IV–XI	1976-1979 Monthly average		Monthly average
Di	c	0.8	—	—	—	—	—	1.6	—	2.4	0.30	4.53	1.13
	v	0.8	—	—	—	0.8	—	4.0	1.6	7.2	0.90	5.38	1.34
Co	c	58.0	22.4	24.8	0.8	40.8	48.8	24.8	16.0	235.6	29.45	921.38	230.34
	v	58.0	36.0	60.0	28.8	96.8	543.2	112.8	156.0	1091.6	136.45	722.24	180.56
O	c	—	25.6	130.4	24.8	13.6	3.2	1.6	—	199.2	24.90	64.0	16.0
	v	—	16.8	90.4	12.0	24.0	2.4	—	—	145.6	18.20	54.85	13.71
Th	c	—	1.6	2.4	0.8	0.8	—	0.8	—	6.4	0.80	8.21	2.05
	v	—	4.0	2.4	—	0.8	0.8	—	—	8.0	1.00	7.97	1.99
Het	c	—	1.6	4.8	4.8	6.4	—	2.4	—	20.0	2.50	25.05	6.26
	v	—	7.2	12.0	—	—	0.8	—	8.8	28.8	3.60	23.02	5.75
Hom	c	14.4	48.8	244.0	16.8	14.4	23.2	67.2	128.0	556.8	69.6	858.58	214.64
	v	14.4	20.0	186.4	80.0	75.2	89.6	44.0	71.2	580.8	72.60	232.41	58.10
Col	c	24.4	8.8	56.0	18.4	10.4	10.4	3.2	16.8	156.4	19.55	171.35	42.83
	v	24.4	15.2	79.2	20.8	11.2	35.2	17.6	24.8	228.0	28.50	183.02	45.75
Lep	c	0.4	12.8	24.8	0.8	1.6	3.2	0.8	—	44.4	5.55	25.42	6.35
	v	0.4	13.6	28.8	4.0	17.6	22.4	2.4	—	89.2	11.17	30.60	7.65
Dipt	c	68.0	55.2	57.6	67.2	39.2	20.8	24.0	12.8	344.8	43.10	337.46	84.36
	v	68.0	55.2	52.8	123.2	91.2	72.0	53.6	16.0	532.0	66.50	333.7	83.42
Form	c	71.2	241.6	308.8	724.8	529.6	22.4	16.0	1.6	1916.0	239.5	714.6	178.65
	v	71.2	453.6	492.0	382.4	176.8	72.8	27.2	53.6	1729.6	216.2	640.2	160.05
Hym	c	1.6	7.2	32.8	4.8	13.6	53.6	55.2	7.2	176.0	22.0	140.85	35.21
Others	v	1.6	35.2	55.2	15.2	29.6	67.2	78.4	8.8	291.2	36.4	167.55	44.88
Aran	c	12.0	8.8	15.2	13.6	14.4	31.2	20.8	4.8	120.8	15.1	58.54	14.63
	v	12.0	28.0	24.0	8.0	21.6	25.6	18.4	14.4	152.0	19.0	69.47	17.36
Acari	c	16.4	6.4	52.8	4.8	2.4	4.8	11.2	11.2	110.0	13.75	300.55	75.13
	v	16.4	10.4	8.8	—	—	24.0	10.4	22.4	92.4	11.55	217.65	54.41
Others	c	5.2	28.0	38.4	0.8	—	0.8	—	0.8	74.0	9.25	222.14	55.53
	v	5.2	131.2	13.6	4.8	0.8	2.4	—	3.2	161.2	20.15	108.07	27.01
Total	c	272.4	468.8	992.8	883.2	694.4	222.4	229.6	199.2	3962.8			
	v	272.4	826.4	1105.6	679.2	546.4	958.4	368.8	380.8	5138.0			

cases, because of favourable rainy weather. So not only the survival of growing insects is for sure, but also the entities arriving from the surrounding pastures can find the conditions necessary to their existence.

Distribution according to space levels

The examined area can be distributed into two levels: the sand dune with higher, dryer microclimate and the lower, wet windfurrow. The fauna of the space levels, the number of growing entities on a unit area are possibly different because of different natural conditions, vegetation cover and phytocenosis. Although we didn't get to analysis according to species, it seems practical to mention the differences found in the case of each group (Table V). Since the traps have been set up on both levels only from 1977, the data of 1976 are hot shown in this Table.

Examining the global data of constant traps it can be stated that 39% of the examined Arthropoda were growing in the windfurrow, as regards the average of 3 years. It is different in each group of course. For example the Collembola, the Heteroptera the Coleoptera and the Diptera are approximately distributed equally between the two levels. The Diplopoda, the Thysanoptera, the Lepidoptera and the Araneidea prefer the wind-furrow, while the Orthoptera, the Homoptera, the Hymenoptera and the Acari orders prefer the sand dunes. The meteorological factors can change the exact numerical ratios, what can be illustrated by the data of the rainy 1978.

The data coming from the changing traps show different proportions. The proportion of the individuals of the Hymenoptera and the Acari moving in the windfurrows increased, it did not change in the case of the Diplopoda, Orthoptera, Homoptera, Coleoptera, Diptera and Araneida; and decreased in the cases of the Collembola, Thysanoptera, Heteroptera, and Lepidoptera orders. On an annual average Hymenoptera and Acarida growing in the sand dunes willingly make use of windfurrows, while the Collembola, Thysanoptera, Heteroptera and Lepidoptera growing in wind-furrows prefer sand dunes. It does not mean however that the other populations remain in their place of development during the whole year, because they can also react seasonally to the changes of conditions with migration, and significant deviation from the average can be observed in both directions.

The Araneida which generally prefer the wind-furrow, prefer the sand dune in spring and at the beginning of summer, while in the end of summer the proportion shifts in favour of the wind-furrow. The Acarida behave similarly. The spring peak of the Orthoptera populations is in the sand dune, in summer the majority prefer the wind-furrow, while in autumn they dominate in the sand duna again. The same type of dynamics can be recognised in the case of the Collembola. More Diptera appear in the windfurrow in spring, in summer the difference is balanced, while in the autumn of 1979 there were more of them in the sand dunes. The draught-resistance and the need of the Heteroptera forwarm are shown by the fact that double peak appear on both levels, but the mid-summer decrease is smaller in the sand dune than in the wind-furrow, i.e. the proportion is shifted in favour of the higher space level.

Table 5. Monthly density data in wind furrows (Wf) and sand dunes (Sh) in the years 1977–1979.

1977

		Di	Co	O	Th	Het	Hom	Col	Lep	Dipt	Hym	Aran	Acari	Others	Total
April	c Wf	2	406	—	4	2	38	46	—	138	274	24	336	262	1532
	Sh	—	509.3	9.3	—	—	97.3	54.6	—	60	81.3	8	369.3	158.6	1347.7
	v Wf	—	408	—	4	—	16	60	—	592	12	8	124	56	1280
	Sh	—	1320	6	—	1	97	50	—	123	86	17	202	19	1921
May	c Wf	—	596	4	—	6	60	124	12	222	178	54	342	98	1695
	Sh	—	1132	56	1.3	5.3	96	81.3	26.6	137.3	105.3	4	274.6	185.3	2105
	v Wf	4	528	16	4	4	288	412	32	280	856	24	76	292	2816
	Sh	—	795	86	2	5	299	175	25	178	219	17	246	49	2096
June	c Wf	8	108	40	—	—	36	136	88	488	144	28	96	40	1212
	Sh	—	468	81	9	26	1154	216	9	281	451	65	193	418	3371
	v Wf	—	124	8	—	20	20	72	16	300	168	44	132	32	936
	Sh	1.3	154	18	2	7	85	48	14	249	575	68	63	109	1393.3
July	c Wf	—	64	12	8	8	24	89	8	352	76	12	64	180	896.
	Sh	—	261	32	6	14	1577	58	1	121	361	12	173	585	3201
	v Wf	—	154	42	4	2	20	44	—	186	268	44	44	56	864
	Sh	—	32	10.6	—	6.6	16	14.6	—	24	98.6	12	29.3	54.6	298.3
Aug	c Wf	4	56	52	28	4	96	52	56	220	180	20	28	24	820
	Sh	—	91	16	1	15	260	41	2	101	228	8	62	27	852
	v Wf	2	172	6	4	16	50	18	4	82	90	20	26	20	510
	Sh	—	24	2.6	1.3	10.6	68	28	1.3	44	84	2.6	25.3	—	291.7
Sept	c Wf	4	84	20	12	—	60	44	16	48	24	12	8	8	340
	Sh	—	66	6	4	8	673	29	9	75	236	12	73	79	1270
	v Wf	4	86	4	4	2	16	16	4	92	116	20	136	8	508
	Sh	—	13.3	14.6	2.6	6.6	76	30.6	40	28	153.3	13.3	16	5.3	399.6
Oct	c Wf	16	20	—	—	2	—	28	—	28	32	8	40	8	182
	Sh	8	5	2	2	6	447	52	2	63	197	9	21	13	827
	v Wf	12	—	4	—	—	16	24	—	76	20	12	8	—	172
	Sh	6.6	—	4	—	4	21	28	—	68	42	6	5	7	191.6
April–Oct	c Wf	34	1334	128	52	22	314	518	180	1496	908	158	914	620	6678
	Sh	8	2532.3	202.3	23.3	74.3	4304.3	531.9	49.6	838.3	1659.6	118	1165.9	1465.9	12 973.7
	v Wf	22	1472	80	20	44	426	646	56	1608	1530	172	546	464	7086
	Sh	7.9	2338.3	141.8	7.9	40.8	662	374.2	80.3	714	1257.9	135.9	586.6	243.9	6591.5
Monthly average	c Wf	4.58	190.57	18.28	7.43	3.14	44.86	74	25.71	213.71	129.71	22.57	130.57	88.57	953.97
	Sh	1.14	361.75	28.9	3.33	10.61	614.9	75.98	7.08	119.76	237.08	16.86	166.55	209.41	1853.35
	v Wf	3.14	210.28	11.43	2.86	6.28	60.86	92.28	8	229.7	218.57	24.57	78	66.28	1012.25
	Sh	1.13	334.0	20.26	1.13	5.83	94.57	53.46	11.47	102	179.7	19.41	83.8	34.84	941.6

Table 5. 1978

		Di	Co	O	Th	Het	Hom	Col	Lep	Dipt	Hym	Aran	Acari	Others	Total
April	c Wf	8	126	—	4	4	10	38	2	14	44	10	20	—	280
	Sh	2.6	32	—	1.3	2.6	18.6	20	—	10.6	34.6	3.9	86.6	1.3	214.1
	v Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sh	1.6	48	—	2.4	—	32.8	31.2	—	37.6	92	9.6	96.0	—	351.2
May	c Wf	2	156	2	16	2	24	46	4	72	30	2	60	2	418
	Sh	—	13.3	1.3	3.9	2.6	22.6	34.6	5.3	64	37.3	12	12	—	208.9
	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sh	—	89.6	4.8	5.6	3.2	41.6	28.8	9.6	22.4	135.2	14.4	55.2	3.2	413.6
June	c Wf	4	64	—	2	2	68	68	8	98	62	2	132	14	524
	Sh	—	61.3	6.6	2.6	—	756	34.6	9.3	114.6	89.3	10.6	64	6.6	1155.5
	v Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sh	—	28.8	25.6	7.2	5.6	76.8	43.2	8.8	141.6	215.2	6.4	55.2	36.8	651.2
July	c Wf	2	194	20	4	22	116	46	6	184	344	24	74	4	1040
	Sh	—	113.3	10.6	5.3	6.6	304	40	5.3	210.6	72	12	161.3	5.3	946.3
	v Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sh	—	176.8	5.6	12.0	4.0	90.4	32.8	4.8	130.4	244.8	19.2	80.8	14.4	815.2
Aug	c Wf	8	706	2	8	62	186	52	20	200	172	32	98	24	1570
	Sh	—	165.3	1.3	1.3	8	146.6	33.3	20	110.6	396	21.3	141.3	23.9	1068.9
	v Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sh	9.6	327.2	9.6	0.8	10.4	56.0	80.8	17.6	227.2	331.2	25.6	44.0	14.0	1153.2

Sept	c	Wf	4	130	2	—	14	570	50	—	80	128	18	80	36	1112
		Sh	—	141.3	2.6	—	10.6	42.6	22.6	8	80	201.3	13.3	29.3	1.3	552.9
	v	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Sh	2.4	110.4	0.8	—	2.4	23.2	25.6	4.8	63.2	132.8	12.0	15.2	4.0	396.8
Oct	c	Wf	4	106	2	—	6	354	48	—	104	104	14	—	10	752
		Sh	4	133.3	1.3	—	—	56	24	—	361.3	64	16	140	5.3	805.2
	v	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Sh	7.2	168.8	—	2.4	2.4	60.8	31.2	0.8	284.8	148.8	12.8	108.8	2.4	831.2
Nov	c	Wf	2	6	—	—	—	82	4	—	12	24	14	19	2	156
		Sh	5.3	16	—	—	—	29.3	9.3	—	105.3	32	6.6	13.3	1.3	218.4
	v	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Sh	7.2	16.8	—	—	2.4	8.0	19.2	3.2	28.0	8.0	9.6	7.2	—	109.6
April–Nov	c	Wf	34	1488	28	34	112	1410	352	40	764	908	116	474	92	5852
		Sh	11.9	675.8	23.7	14.4	30.4	1375.7	218.4	47.9	1057	926.5	95.7	647.8	45	5170.2
	v	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Sh	28	966.4	46.4	30.4	30.4	389.6	291.2	49.6	935.2	1308.0	109.6	462.4	74.8	4722.0
Monthly average	c	Wf	4.25	186	3.5	4.25	14	176.25	44	5	95.5	113.5	14.5	59.25	11.5	731.5
		Sh	1.49	84.48	2.96	1.8	3.8	171.96	27.3	5.99	132.12	115.81	11.96	80.98	5.62	646.27
	v	Wf	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Sh	3.5	120.8	5.8	3.8	3.8	48.7	36.4	6.2	116.9	163.5	13.7	57.8	9.35	590.25

Table 5. 1979

		Di	Co	O	Th	Het	Hom	Col	Lep	Dipt	Hym	Aran	Acari	Others	Total
April	c Wf	2	70	—	—	—	12	10	—	52	4	16	26	2	194
	Sh	—	52	—	—	—	17.3	17.3	—	86.6	58.6	5.3	10.6	6.6	254.3
	v Wf	—	16	—	—	—	12	34	—	94	6	10	12	6	190
	Sh	1.3	84	—	—	—	14.6	34.6	1.3	42.6	177.3	17.3	18.6	5.3	396.9
May	c Wf	—	8	12	—	4	16	10	20	32	230	8	6	62	408
	Sh	—	32	34.6	2.6	—	70.6	8	8	70.6	261.3	9.3	6.6	5.3	508.9
	v Wf	—	44	16	—	—	—	4	2	20	52	16	8	32	194
	Sh	—	34	17	5	9	25	18	16	64	598	31	11	156	984
June	c Wf	—	12	76	2	2	182	58	22	56	314	20	38	40	822
	Sh	—	33.3	166.6	2.6	6.6	285.3	54.6	26.6	58.6	360	12	62.6	37.3	1106.1
	v Wf	—	—	84	4	—	32	32	4	12	132	16	24	—	340
	Sh	—	75	92	2	15	225	91	35	63	651	26	5	17	1297
July	c Wf	—	2	18	—	4	28	16	2	34	120	16	—	2	242
	Sh	—	—	29.3	1.3	5.3	9.3	20	—	89.3	1136	12	8	—	1310.5
	v Wf	—	16	4	—	—	12	—	—	96	304	12	—	4	448
	Sh	—	32	14	—	—	97	26	5	130	421	7	—	5	737
Aug	c Wf	—	52	4	—	2	18	6	4	32	62	10	6	—	196
	Sh	—	32	20	1.3	9.3	12	26.6	—	44	864	17.3	—	—	1026.5
	v Wf	4	60	12	4	—	—	8	72	92	88	8	—	—	348
	Sh	—	106	27	—	—	94	12	4	91	236	25	—	1	596
Sept	c Wf	—	32	2	—	—	20	4	4	4	44	50	—	—	160
	Sh	—	60	4	—	—	25.3	14.6	2.6	32	97.3	18.6	8	1.3	263.7
	v Wf	—	176	2	2	2	10	26	22	78	158	52	54	6	588
	Sh	—	788	2.6	—	—	142.6	41.3	22.6	68	128	8	4	—	1205.1

Oct	c	Wf	2	22	—	2	—	16	6	2	6	46	22	22	—	146
		Sh	1.3	26.6	2.6	—	4	101.3	1.3	—	36	88	20	4	—	285.1
	v	Wf	20	160	—	—	—	16	12	—	12	136	24	—	—	380
		Sh	—	101	—	—	—	51	19	3	64	98	17	13	1	367
Nov	c	Wf	—	14	—	—	—	30	6	—	8	2	6	2	—	68
		Sh	—	17.3	—	—	—	193.3	24	—	16	13.3	4	17.3	1.3	286.5
	v	Wf	8	84	—	—	—	4	48	—	12	212	12	36	8	424
		Sh	—	174	—	—	—	88	19	—	17	25	15	19	1	358
April–Nov	c	Wf	4	212	112	4	12	322	116	54	224	822	148	100	106	2236
	v	Wf	32	556	118	10	2	86	164	100	416	1088	150	134	56	2912
		Sh	1.3	1394	152.6	7	24	737.2	260.9	86.9	539.6	2334.3	146.3	70.6	186.3	5941
Monthly average	c	Wf	0.5	26.5	14	0.5	1.5	40.25	14.5	6.75	28	102.75	18.5	12.5	13.25	279.5
		Sh	0.16	31.65	32.14	0.98	3.15	89.3	20.8	4.65	54.14	359.81	12.31	14.64	6.47	630.2
	v	Wf	4	69.5	14.75	1.25	0.25	10.75	20.5	12.5	52	136	18.75	16.75	7	364
		Sh	0.16	174.25	19.07	0.87	3	92.15	32.61	10.86	67.45	291.79	18.29	8.82	23.29	742.61

1977–1979

			Di	Co	O	Th	Het	Hom	Col	Lep	Dipt	Hym	Aran	Acari	Others	Total
1977–1979	c	Wf	72	3034	268	90	146	2046	986	274	2484	2638	422	1488	818	14766
		Sh	21.2	3461.3	483.1	45.5	129.9	6394.4	916.7	134.7	2328.4	5464.6	312.2	1930.8	1562.7	23185.5
	v	Wf	54	2028	198	30	46	512	810	156	2024	2618	322	680	520	9998
		Sh	37.2	4698.7	340.8	45.3	95.2	1788.8	926.3	216.8	2188.8	4900.2	391.8	1119.6	505	17254.5
Monthly average	c	Wf	3.13	131.91	11.65	3.91	6.35	88.95	42.87	11.91	108	114.69	18.35	64.69	35.56	641.97
		Sh	0.92	150.49	21	1.98	5.65	278.02	39.86	5.85	101.23	237.59	13.57	83.95	67.94	1008.05
	v	Wf	3.6	135.2	13.2	2	3.06	34.13	54	10.4	134.93	174.53	21.47	45.33	34.67	666.52
		Sh	1.62	204.29	14.82	1.97	4.14	77.77	40.27	9.42	95.16	213.05	17.03	48.68	21.96	750.18

The seasonal dynamics of the main groups

Although the mosaic-complex character of the area could allow to discuss the seasonal dynamics according to space levels respectively, we don't aim to consider it in the present paper, as above we have mentioned the significance of the space levels in the development of the groups, and we saw the difference in the amount of insects growing by unit areas. On the other hand in connection with the group approach we can suppose that although the levels harshly differ as regards the number of animals growing there, probably these animals do not spend all their life on the same level, i.e. they can make use of either the sand dune or the wind-furrow. This explains our interaction to examine the area as a whole.

Among the phytophages the Orthoptera are salient as regards their significance. It is the first herbivorous group because of the biomass, if not because of its number of entities (Table IV), (GALLÉ et al., 1981). Its seasonal dynamics shows a high peak, which is always in early summer in each of the 4 years (Fig. 5). It is because of the larvae growing mainly then. They proliferate mainly in rainless, dry years; the density can be 2–3 times higher than that of the rainy years' data. After the May–June peak their number decreases rapidly.

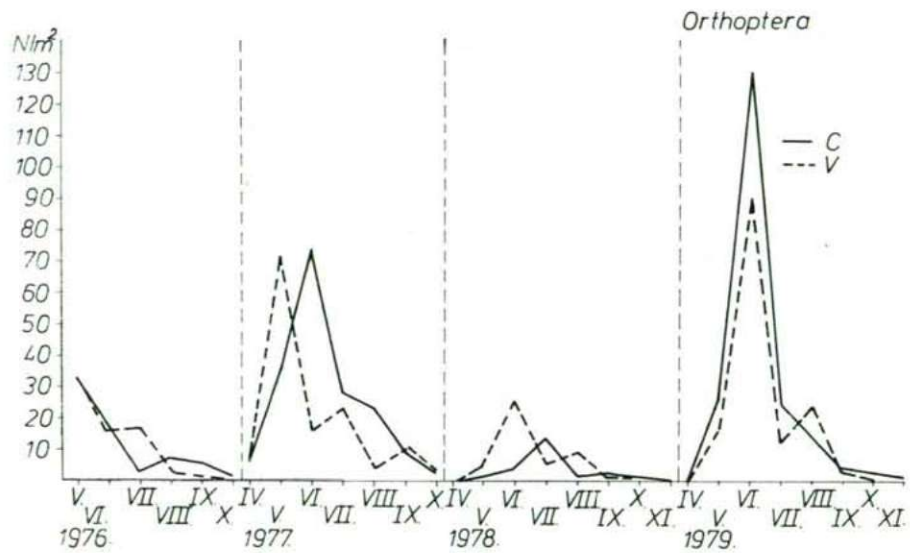

Fig. 5. Seasonal dynamics of Orthoptera.

Among the phytophages the Homoptera order has the biggest number of entities. Its seasonal dynamics is not so definite as the Orthoptera's, because this order is rather homogeneous. Although the steady and numerous presence of the aphids is not characteristic for the area, they cause the high number of specimens under the constant traps. It is clear, that although aphids can grow in the area, their majority leaves this living place (Fig. 6). The data of the changing traps contain mainly the members of the Cicadina suborder. In every year a two-peaked curve can

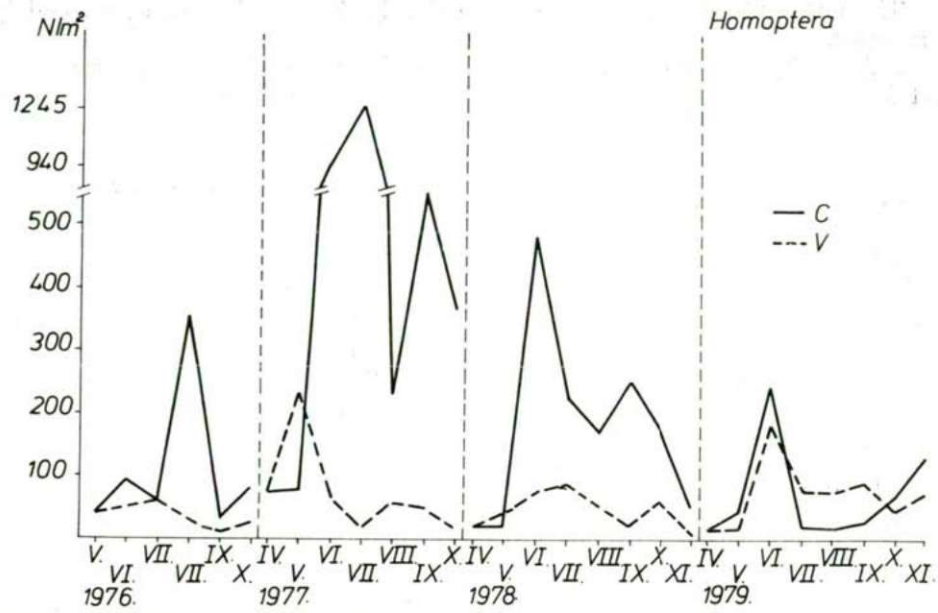

Fig. 6. Seasonal dynamics of Homoptera.

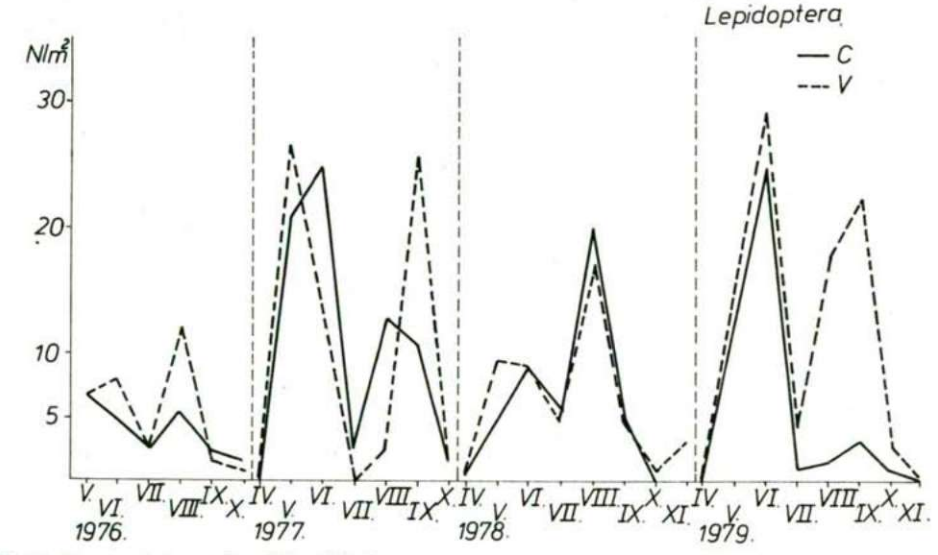

Fig. 7. Seasonal dynamics of Lepidoptera.

be observed. The first, generally the higher peak falls on the late spring, early summer period, and the second one falls on late summer.

We can also find a rather definite dynamism in the case of the Lepidoptera in the examined years. Its peak of flight is in May–June and August–September (Fig. 7). The density of individuals was almost the same during the 3 years.

The Heteroptera's density is similar (Fig. 8). The aphids are active mainly in summer.

Neither the number of the Heteroptera nor that of the Thysanoptera is so high that definite trends could be separated (Fig 9).

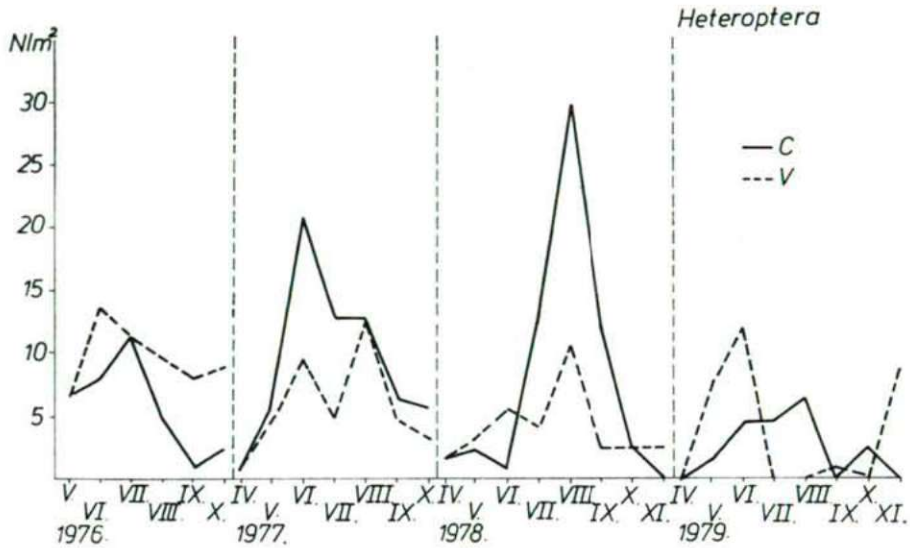

Fig. 8. Seasonal dynamics of Heteroptera.

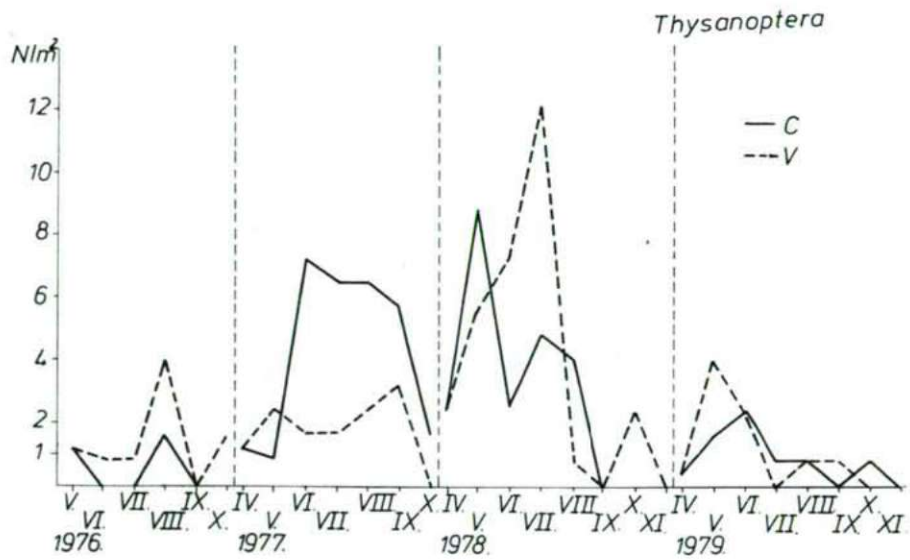

Fig. 9. Seasonal dynamics of Thysanoptera.

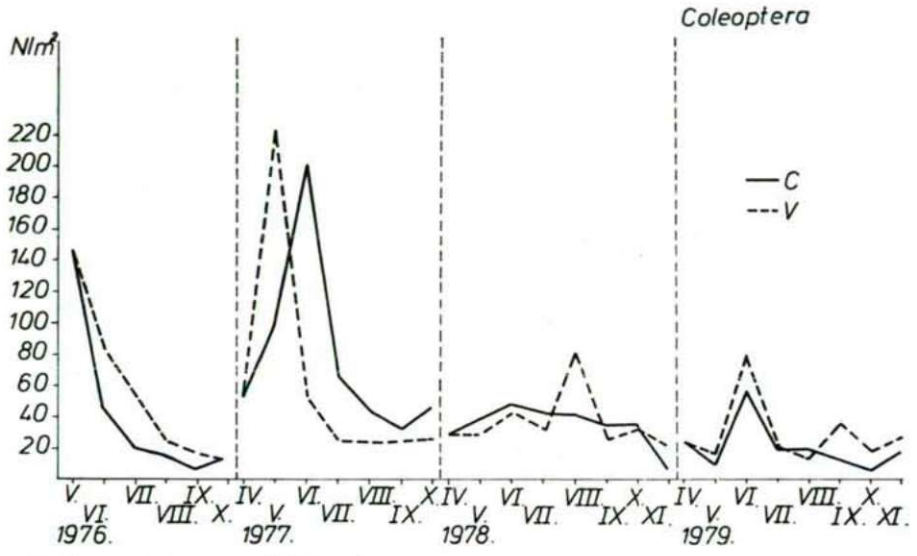

Fig. 10. Seasonal dynamics of Coleoptera.

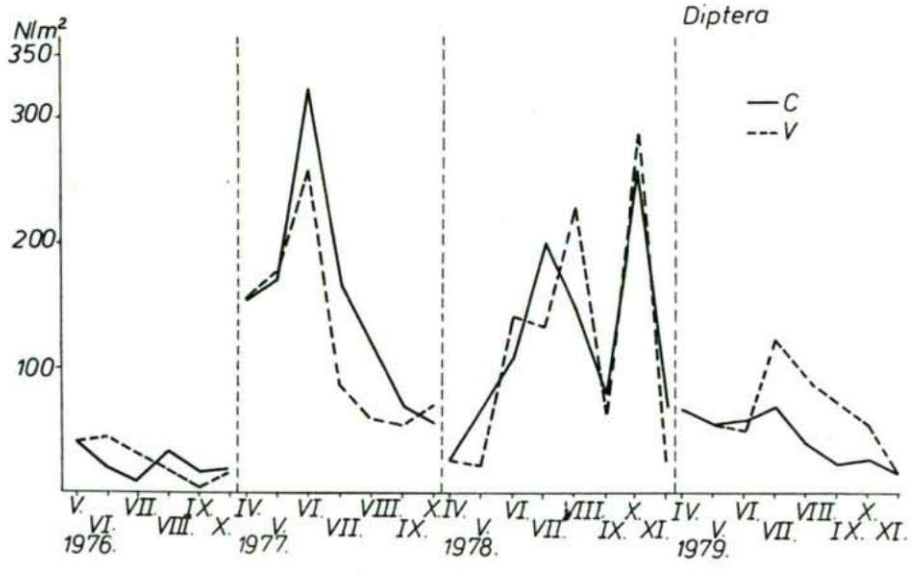

Fig. 11. Seasonal dynamics of Diptera.

The amount of the Coleoptera was more significant in the first two years, but the density in 1978–1979 decreased to half of the original amount (Fig. 10). The most possible reason for this is that after grazing the Scarabaeidae species gradually disappears from the area. That's why the previous definite peak of the number of individuals became indistinct or shifted to summer (1978) or changed into a curve with two peaks (1979).

The Diptera order — the number of species of which is rather high-is represented by very heterogeneous populations as regards nutrition biology. This might cause the group's different behaviour considering seasonal dynamics (Fig. 11). Its number of individuals generally reaches the peak in summer (June–July), but in 1972 there was a second peak in late autumn. The reason for the low density in 1976 might be the fact that the area freed from graze had not reached the appeal of the next years, more characteristical phytocenosis that ensured the mobile Diptera populations of the surrounding areas.

On the other hand the more favourable possibilities of development that appeared in 1976 have made their effect felt only from the next years. It seems that the boom of the start develops towards a state of balance, and in 1979 it reaches the double of the density of the first year. The accurate examination of all these is certainly possible only after the classification to the species and the evaluation of populations respectively.

The seasonal dynamics of the Hymenoptera is determined by the Formicoidea (Fig. 12). Its peak is in June–August. The other Hymenoptera — which are the 0.1–0.2 part of the whole — do not show such great oscillation. Generally there is a June and a September–October peak in the number of individuals, but there was no summer decline in 1978, because this year had a steady climate, and the peak lasted from July to September.

The seasonal dynamics of the spiders (Fig. 13) was rather various during the 4 years. Generally we found the minimum of density in the warmest months, if followed by draught. BALOGH and LOKSA (1948) also found the minimum in August in the Festucetum vaginatae association in the case of two dominant species, while

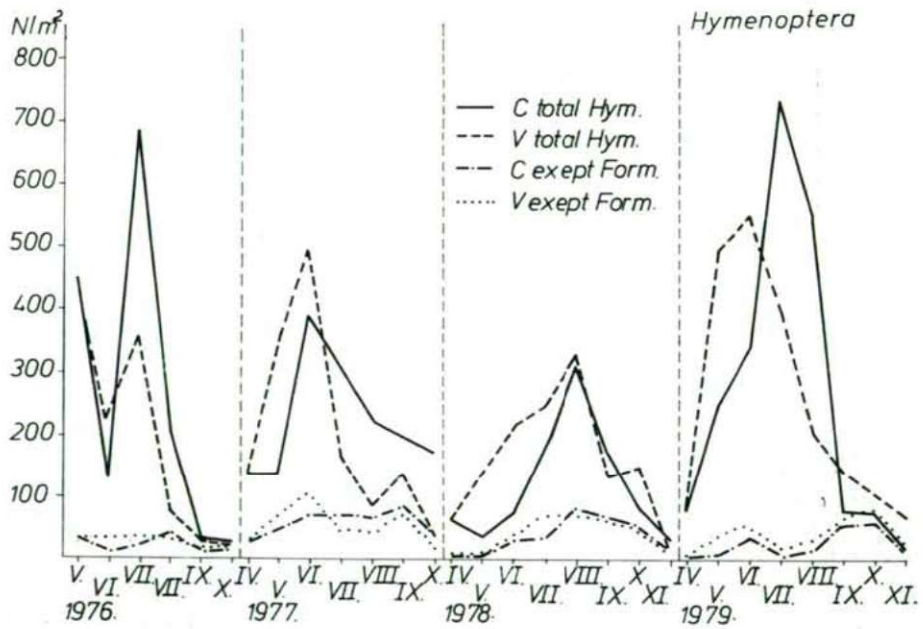

Fig. 12. Seasonal dynamics of Hymenoptera.

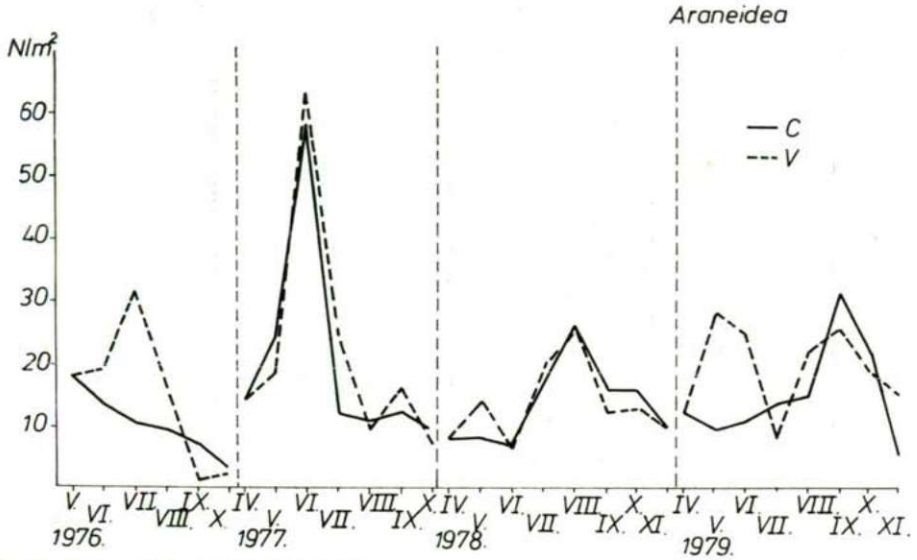

Fig. 13. Seasonal dynamics of Araneidea.

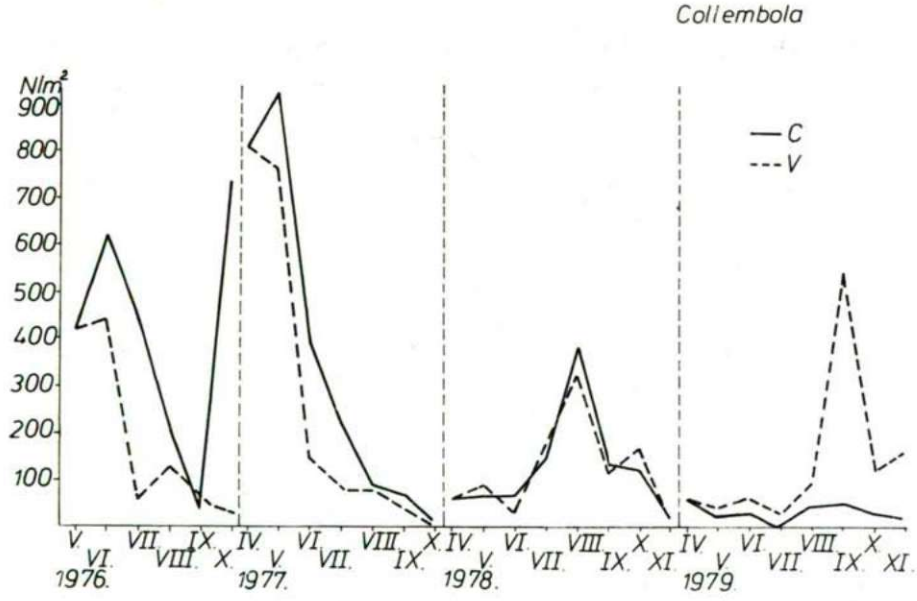

Fig. 14. Seasonal dynamics of Collembola.

FARKAS stated (1978) that the seasonal dynamics shows a saturation curve with a small summer decline.

The fewest of the decomposer Collembola got to the traps in the warm summer months (Fig. 14). In 1978 however it reached an August peak because of the rainy

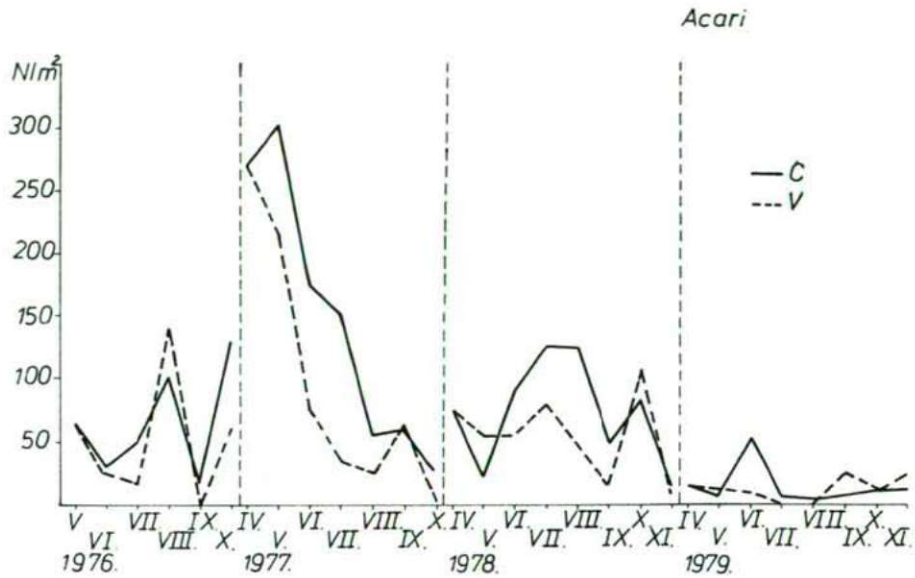

Fig. 15. Seasonal dynamics of Acari.

weather. It is very difficult to find seasonal trends in the behaviour of the group because it may completely differ in the case of each species.

In the case of the Acari a definite, regular dynamics cannot be found (Fig. 15). The density of 1977 — about 300 p/m² — was decreasing rapidly till 1979, so the significance of the Acari — at least that of those, which move in the vegetation and on the soil surface — continuously declines.

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